



# Editing a Distributed Fact Base With an ORG Chart

by Howell Caton

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## **Editing a Distributed Fact Base With an ORG Chart**

**Howell Caton**

Computational and Information Sciences Directorate, ARL

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## **Abstract**

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This document is a guide to using ORG Chart. ORG Chart was originally a tool for displaying organization tables in a tree format of U.S. Army units and tables of organization and equipment. The data that ORG Chart displays is kept in a distributed fact base, a component of the Information Distribution Technology software that was developed at the U.S. Army Research Laboratory. ORG Chart has recently been augmented to provide a convenient and efficient interface for entering data into a distributed fact base. This document is a guide to using ORG Chart in both its display capacity and its data input capacity.

## Acknowledgments

The author would like to thank Sam Chamberlain, Fred Brundick and George Hartwig for their significant contributions to this project. This software was Sam's idea, and he inspired many of its features. George understands the details of the Information Distribution Technology (IDT) software better than anyone, and writing this program would have been impossible without him. Fred mentored the author through the arduous task of learning X Window System programming, an essential contribution. George provided a thorough review, a tedious and nearly thankless task.

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# 1. Introduction

This document is a guide to using ORG Chart. ORG Chart was documented in 1991 in a memorandum report written by Kenneth J. Smith (1991a). Originally, ORG Chart was a tool for displaying organization tables in a tree format for US Army units and tables of organization and equipment (TOE) structures. It can also be used to display field units on a map. Recently, features have been added to ORG Chart that require further documentation. The data that ORG Chart displays is kept in a distributed fact base (DFB) (Chamberlain 1990). A DFB is a database module that is a component of the Information Distribution Technology (IDT) software that was developed at the U.S. Army Research Laboratory (ARL). Refer to the background section for further information on IDT. The features that were recently added to ORG Chart are the ability to add facts to and edit facts in a DFB. This report and the Smith report both contain adequate information for understanding and using the ORG Chart program.

New information can be entered directly into a DFB using the library package, *libdkb*. If a large amount of data is to be entered, as is often the case, this approach is frustratingly slow. In 1991, Ken Smith (1991c) wrote a utility, *load\_dfb*, that automates the use of *libdkb* to enter data into a DFB. *Load\_dfb* reads data from preformatted files. The disadvantage of this program is that the formatting is required to be quite precise and therefore, tedious. This project is intended to address those limitations by providing an easy-to-use graphical tool for submitting data to a fact base. This was accomplished by expanding the X-based ORG Chart program to provide a menu-driven interface for loading data into a fact base. An especially powerful feature of ORG Chart is the ability to copy an entire tree structure (or any part thereof) of elements composed of real units or TOE models. Global replacement of character substrings within key fields permits the user to avoid having to edit each new fact in the DFB.

## 2. Background

In this era of reduced budgets and fewer personnel, the need to capitalize on technology as a force multiplier is greater than ever. The modern U.S. Army hopes to offset these limitations with highly maneuverable combined arms teams. One critical factor in this scenario is maintaining the communication links necessary for command and control, and disseminating time-critical intelligence to the soldier. The narrow bandwidth communications available with Combat Net Radios (CNR) is a troublesome limitation in view of this requirement.

The solution developed by the Information Sciences and Technology Directorate (ISTD) of the U.S. Army Research Laboratory, formerly the Ballistic Research Laboratory (BRL), was an experimental IDT program to explore innovative concepts to facilitate the exchange of tactical information over low bandwidth communication channels. IDT started as part of the Defense Advanced Research Projects Agency (DARPA), U.S. Army Distributed Communication and Processing Experiment (Chamberlain 1986) and continued as part of the Smart Weapons Systems (SWS), U.S. Army Laboratory Command (LABCOM) Cooperative Program (Rogers 1991). It was supported as part of the U.S. Army Communication and Electronics Command (CECOM) Directorate for the C3 System's Low Echelon Command and Control (LEC2) Program. IDT was later used by the Communications and Network Division of ISTD for its mission of developing situation awareness (SA) methodologies for the battlefield.

## 3. Chart User's Guide

**3.1 Overview.** ORG Chart is an X-Window System program. It was written in the "C" programming language using the Motif Toolkit. It was developed on a Sun UNIX workstation running the Solaris operating system and has not been ported to any other platform.

The user must have a DFB running before ORG Chart is started. ORG Chart is started

by simply typing "chart" in a command prompt window. The layout of the ORG Chart main window is shown in Figure 1. At the top is a row of cascade buttons. Under that row are two rows of push buttons. Next are three labeled text fields for user input. Under these is a drawing area for representing the organizational structure of units or standard TOE structures in the fact base. TOE components will frequently be referred to as organizations (orgs.). Temporary task force attachments can also appear in the drawing area. They are drawn in a different color than the assigned units. This feature is enabled by editing the controls panel, which is discussed in the next subsection. At the bottom of the main window are three message boxes that show the uses of the three mouse buttons when activated (solid black print). The uses are subject to change, depending on the user's activity.

**3.2 Detailed Use of ORG Chart.** The row of cascade buttons is shown in Figure 2. A pull-down menu appears beneath each of these when activated. The choices under the "Realign" button include:

- Create Task Force
- Reassign

"Create Task Force" is the only way to change the fact base that existed prior to this effort. Pressing this button activates the first and third mouse buttons to act on the drawing area symbols. Create Task Force is used to attach units to other units in a task force created for a specific mission. The left button is used to select the task force subordinate unit (child) from the drawing area. In turn, this action enables the second mouse button to be used to pick the parent. The fact ID of the child will be added to the "attsub" field of the parent unit. Fact IDs are unique identifiers assigned to each fact in a fact base by the IDT software. Also, the parent's fact ID is placed in the child's attpar field. All data fields for all fact types are explained in the Information Distribution System (IDS) Application Programmers Interface Guide (Smith 1991b). The third mouse button can be used to sever an existing task force assignment.

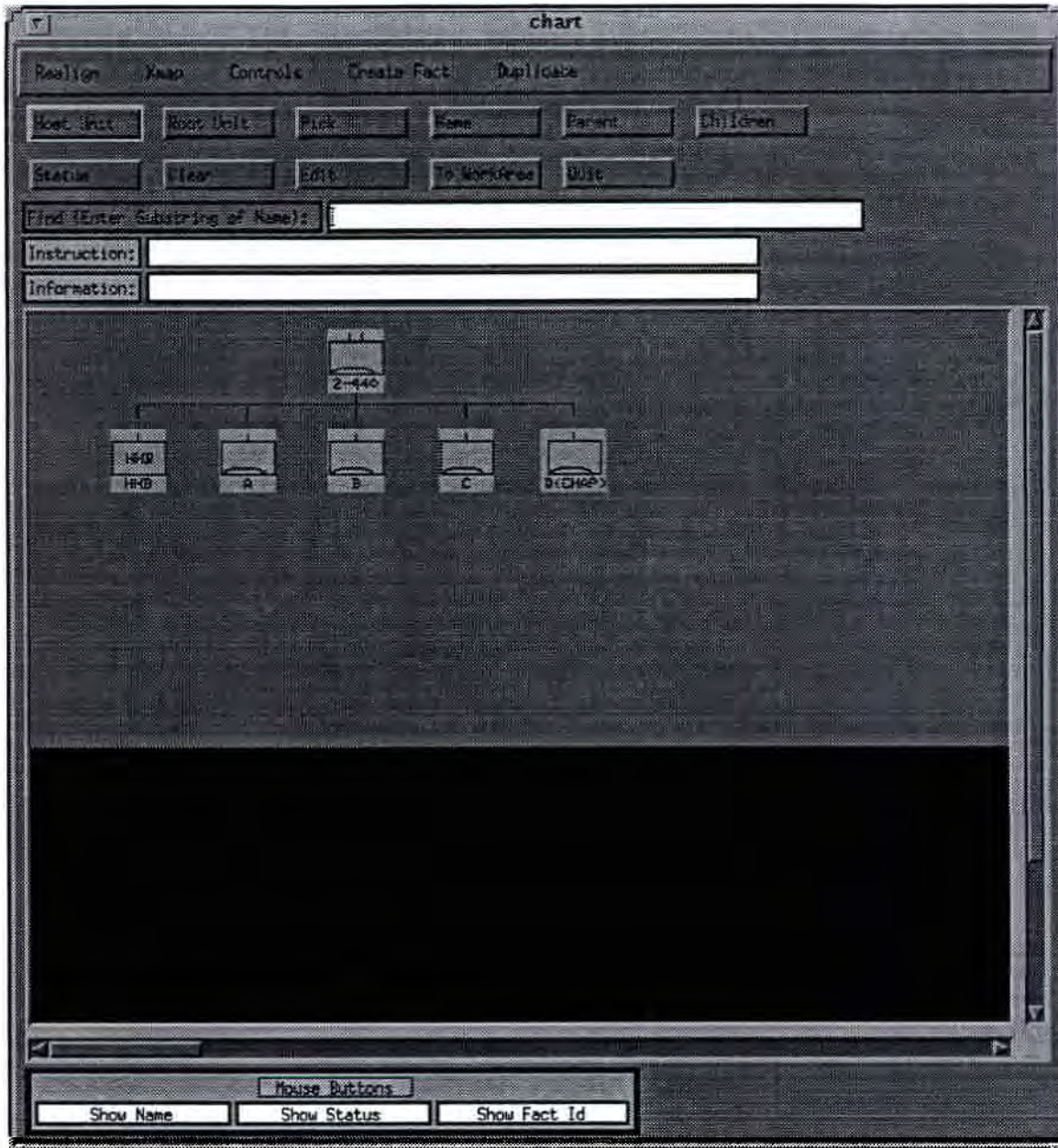


Figure 1. ORG Chart Main Window.



Figure 2. Cascade Buttons.

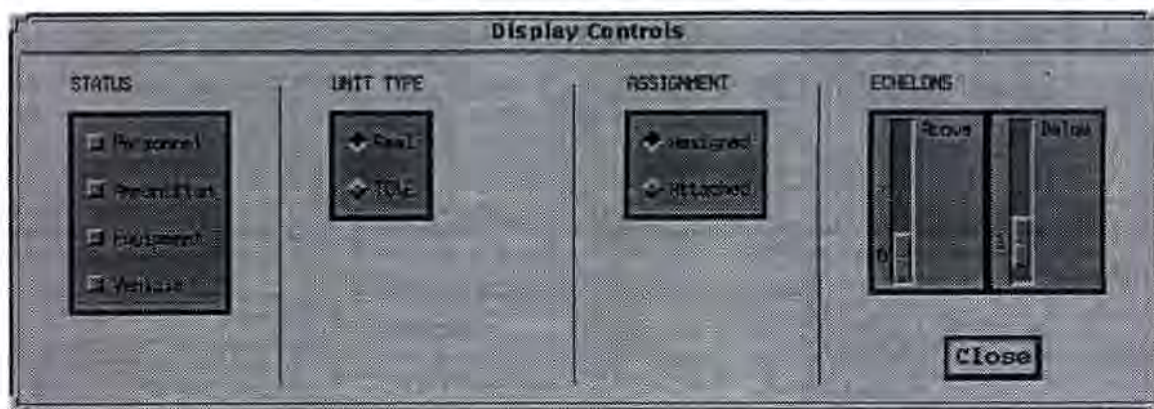
"Reassign," the other choice under Realign, can be used in an analogous manner to affect permanent assignments of units or orgs. through their "par" and "sub" fields.

The "Xmap" cascade button has only one child: "Show Unit." This button activates the left mouse button to select a real unit to be displayed on the Xmap application program in the IDT suite. Xmap displays the spatial deployment of real units.

The "Controls" button and its child, "Edit," are used to "pop up" a control panel, as shown in Figure 3. Check boxes are provided for the user to specify status information to be reported for selected units or orgs. The four parameters listed are personnel, ammunition, equipment, and vehicles. All subsets of these parameters are permitted. There are also radio buttons to select the type of items to be displayed in the drawing area. The choices are real and TOE. The user can also select either Assigned or Attached, which refer to the real units or to task force attachments, respectively. If TOE is selected in the previous block, the Assigned and Attached selections show exactly the same thing. Task force attachments pertain to real units only. Finally, the number of echelons above and below the selected unit or org. (to be displayed in the drawing area) can be changed. The default setting is zero echelons above and one below. "Create Fact" allows the user to select one of several fact types. Once a fact is created, a panel appears with text areas where values for all of the data fields for that fact type can be entered. These can be filled in or left blank, depending on the available data. A sample create-fact panel for an org-type fact is shown in Figure 4.

The data fields for the org-type fact and for the other fact types are explained in the IDS Application Programmers Interface Guide (Smith 1991b). There are four push buttons immediately beneath the header. They are labeled Create/Update, Query/Get, Grab Factid, and Cancel. Beneath these are the variable names and text fields for entering their values. The data can be integers, alphanumeric strings, fact IDs of other facts, and lists. The lists can be lists of any of the other data types. Lists can also be combinations of the other data types. Smith's ORG Chart report (1991a) is a good reference for learning the data types for all the variables for all the fact types.





**Figure 3. Control Panel.**

If the user clicks the Create/Update button, that data is entered into the fact base. References or lists of references can be filled out with a fact ID or a string naming a fact type such as `unit_type`. In the latter case, that type of fact will be created and the corresponding fact ID will be entered into the appropriate field. A panel will pop up to accept input for the new fact. Many reference fields are paired with a list. For example, a `unit_type` fact that references another `unit_type` fact as its parent will be referenced in turn in the others' sub list. A special format has been encoded to handle this situation. The user can type "`unit_type,sub`" in the parent field, and the new fact will be created. Its fact ID will be entered into the parent field; the ID of the other fact will be entered into the subordinate list of the new fact. Alternately, if the parent exists, the actual fact ID of the parent can be substituted for `unit_type` in the previous example, and the appropriate pairing will again take place. This procedure is more easily demonstrated than explained, and the user is urged to seek an experienced user for a demonstration.

The sub and attsub lists of `org_type` facts are special cases. They require the number of identical `org_type` facts that are to be included in the list. So, the proper format to fill out the par field of an `org_type` fact is "`org_type,sub,3`" (or another integer), and the integer will be properly included in the sub list. As before, the fact ID of the parent can be substituted for the string `org_type`.



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Create/Update	Query/Get	Grab FactId	Cancel
---------------	-----------	-------------	--------

pernum	
ldnum	01101000
name	US ADA BN GUN(SP)/STGR
ldname	GUN/STGR
sym	F1BTNAD
ech	BTN
par	@0xc0051725/0x393"
attpar	
sub	@0xc0051725/0x496" 1 @0xc0051725/0x4a0" 3 0
attsub	
veh	
equip	
ammo	

Figure 4. Create Fact Panel for Org\_Type Fact.

Using lists and pairing lists with reference fields violates the rules of normalization of a data base. In a normalized data base, each data field contains only one piece of information, and each piece of information is stored in only one place. The advantages of a normalized data base are important. If an item must be changed, only one data field is changed. In addition, the entire field gets changed, as opposed to only part of it. This greatly simplifies software design and reduces programming errors.

On the other hand, using lists greatly shortens the access time of data base queries. Computing speed is a higher priority on the battlefield than in almost any other environment. Therefore, an executive decision was made to retain the use of lists in IDT software, at least until computer hardware has developed to the point that computing speed is no longer an issue.

Query/Get is used to fill the text fields when the panel refers to a fact that is already in the fact base. Facts already in the fact base can be selected by partially filling the text fields and then selecting Query/Get. In the case of multiple matches, another pop-up will allow the user to select the correct fact. Such a fact can be also be selected with the Edit push button (discussed later).

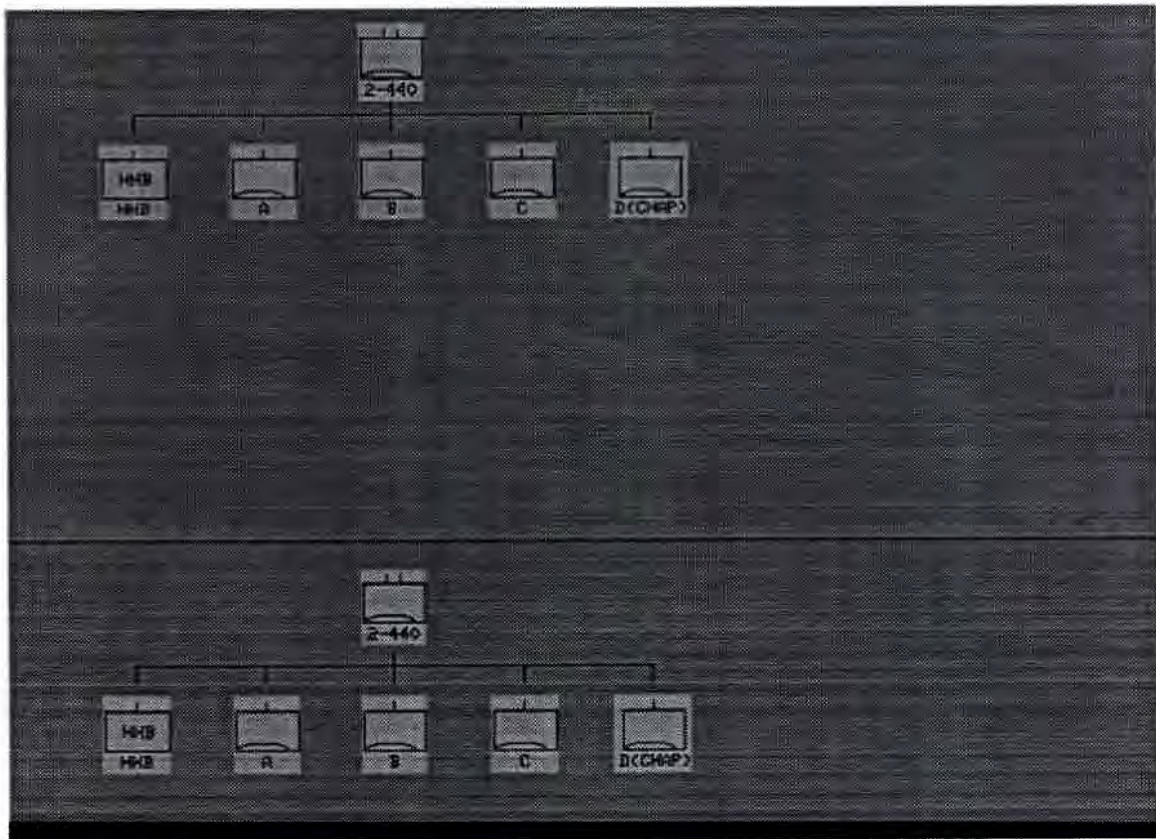
Grab Factid programs the third mouse button to select one of these fact IDs. Once a fact ID is selected, the referenced fact can be edited, or the fact ID can be dumped into a text field of another create-fact panel (again using the third mouse button). "Cancel" cancels the interaction and removes the panel.

The cascade button following Create Fact is labelled Duplicate. This activates a menu that allows the user to duplicate either single units, single orgs., or entire trees. Duplicated units (orgs.) and the roots of duplicated trees are automatically assigned the same parents as the original. The mouse buttons are programmed so the user can reassign a duplicated unit to another parent. After the selection is made, a pop-up panel informs the user if a parent already exists. The user then has the choice of aborting or continuing the reassignment. If no reassignment is wanted, the step through the "abort" option must still be taken to program the mouse keys to perform other useful functions.



For tree duplication, a pop-up text area will query the user for the number of echelons to duplicate. The unit or org selected with the left mouse button determines the root of the tree. An asterisk in the text field means to copy all units subordinate to the root unit. Another panel allows the user to systematically replace any frequently occurring substring of the "name" field with another substring throughout a tree being copied. Duplicated units/orgs. or trees are displayed in the lower half of the drawing area.

Unit\_type and org\_type facts are also displayed in the lower half of the drawing area when created via the Create Fact button. These units can also be selected for further editing with the "Edit Unit" button. Figure 5 shows how and where a duplicated tree is displayed in the drawing area.



**Figure 5. Duplicated Tree Display.**

The two rows of push buttons below the cascade buttons are shown in Figure 6. "Host" causes the display of the host unit/org and specified echelons above and below in the drawing area. Any unit can be designated the host unit by specifying that unit in the cap.ad file read by the DFB when the DFB is started up.



**Figure 6. Push Buttons.**

"Root" displays the root of the tree of units/org. It works by following the parent fields from the host unit/org until there are no more parents. Therefore, this button will not work if there is not a clear line of ascendancy all the way to the root.

"Display" allows another unit or org in the drawing area to be the one that the display is ordered around. "Show Name" causes the name of a unit or org to be displayed in the information text field area. "Parent" causes the displayed tree structure to move up one echelon. "Children" results in the display of a selected unit's or org.'s subordinate units or orgs. "Status" results in the status of a selected unit or org to be displayed in a pop-up panel according to the selected unit's/org.'s parameters in the controls panel. "Clear" wipes clean the entire drawing area; a pop-up panel will verify that this is really what the user intends. "Edit" allows the user to edit a unit or org. that he or she then selects from the drawing area with the left mouse button. "To Work Area" causes a selected unit or org. symbol to be displayed in the lower half of the drawing area. This feature is useful when the displayed tree is so wide or so high that it becomes inconvenient to select certain units or orgs. "Quit" causes the execution of ORG Chart to cease.

Below this row are three text field lines (Figure 7). "Find" is used by typing a substring of a unit's or org.'s idnum field. The DFB is searched, and duplicate finds are listed in a pop-up panel. The user then selects the one desired. "Instruction" is used by ORG Chart to post instructions to the user. Similarly, "Information" is used to post pertinent information

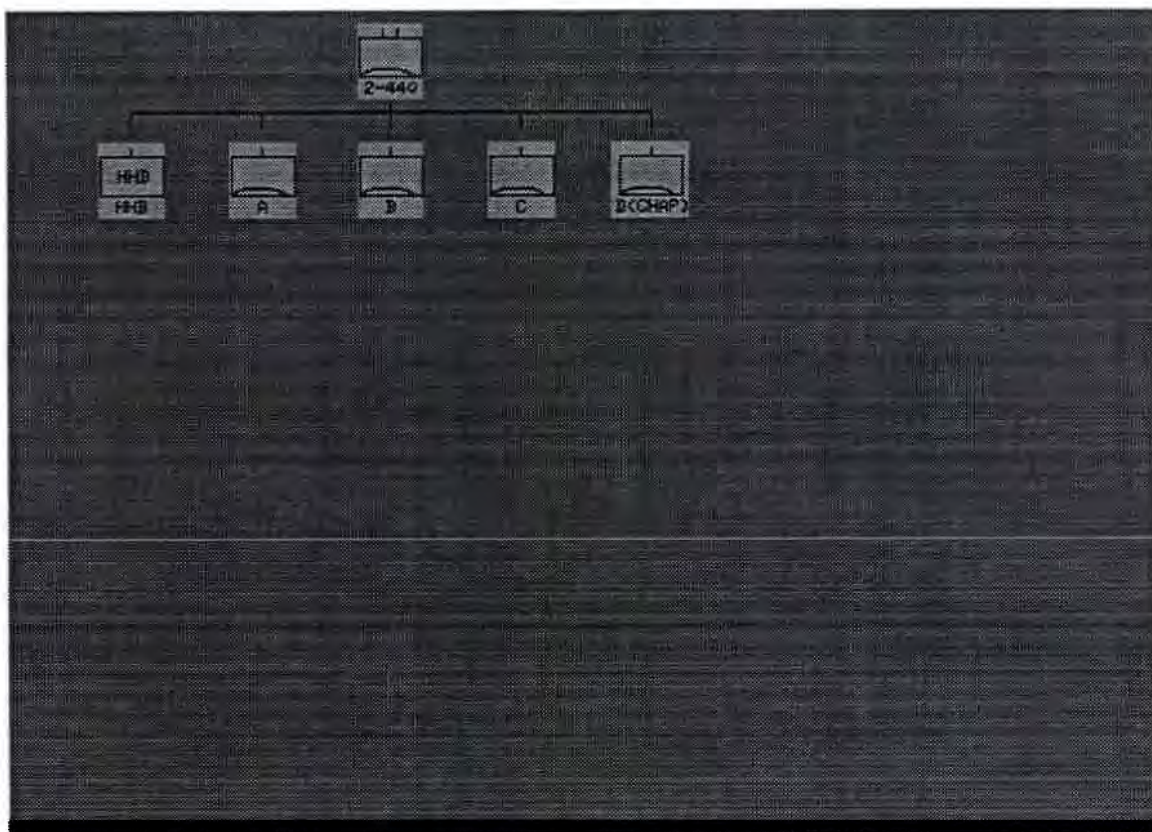


Find (Enter Substring of Name):	<input type="text"/>
Instructions:	<input type="text"/>
Information:	<input type="text"/>

**Figure 7. Text Field Lines.**

to the user.

Below these lines is the drawing area (Figure 8). When a unit or org. is selected for viewing in this area, symbols are drawn showing the organizational structure of the correct number of echelons using a tree diagram. The symbols displayed are actually push buttons. This allows functions to be executed by clicking on the symbols with the mouse buttons.



**Figure 8. Drawing Area.**

At the bottom are three messages that declare the uses of the mouse buttons (Figure 9). If the messages are printed in broken gray letters, the mouse buttons are inactive.



**Figure 9. Mouse Buttons.**

**3.3 Getting Started.** For the neophyte user of ORG Chart, Host Unit is a good place to begin experimenting. Click on Host Unit and then try the Parent and Subunits buttons. If the display becomes crowded, click on Host Unit again and start over. Next, edit the Controls panel and try to understand each subpanel. Try creating facts with the Create Fact menu and duplicate units/orgs. and trees. After this, the user should have a reasonable understanding of the capabilities of ORG Chart.

As noted earlier, the IDT fact base is an unnormalized data base. The rationale for this is discussed in Section 3.2. Many text fields contain fact IDs of other facts. These fields are often paired with list fields of the referenced fact. An example of this includes the par/sub pairings of org\_type and unit\_type facts. The best way to handle such pairings is to work on the reference field, not the list. If the user fills the list field, the number of create\_fact panels popping up on the screen may be overwhelming.

## **4. Ongoing Work**

Work is underway to produce a version of ORG Chart that will connect to any of a number of commercially available relational data bases, thus providing considerable flexibility over the current version. It is being written in Java and will therefore run on several platforms: PC, Macintosh, and UNIX. It will also be more flexible because it will not be tied to any particular naming convention for units, TOEs, and equipment.

## 5. Conclusions

ORG Chart is a major improvement on *load.dfb* for entering data into the fact base. It has none of the tedium associated with the input format. In many cases, the input can be in any of several forms. Duplicating trees allows users to create many facts in a short time. The program has undergone an extensive debugging. Any bugs that have not been found and corrected should not result in a great deal of data being lost. This is because data is sent to the data base with the acceptance of each fact. If the program "breaks," it can be simply started again, and the user can continue from the last completed interaction with the fact base.

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